MT 112, Homework #5, Spring 2020   Name _____

Instructions: Work problems on a separate sheet of paper and attach work to this page. You should show all work to receive full credit for problems. Questions with compact answers can be recorded directly on this page. Graphs and longer answers that won't fit here, indicate which page of the work the answer can be found on and be sure to clearly indicate it on the attached pages. You may use Excel to complete the problems, but then submit Excel files online.

1. You read in a book on poker that the probability of getting 3-of-a-kind in a 5-card poker hand is 1/47. Explain in plain language what this means in terms of proportions.

2. The baseball player Ichiro Suzuki gets a hit about 33.1% of the time over an entire season. After he failed to hit safely in nine straight at-bats, the TV commentator says 'Ichiro is due for a hit by the law of averages.' IS that right? Why? This error is so common it has its own name: The Gambler's Fallacy.

3. The risk of dying in a fatal car crash is many times higher than the risk of dying in an airplane, yet many people are still more afraid of flying than driving to work every day. Explain why this represents a failure to understand probabilities/proportions. You may want to do research on the web for an explanation of the reasons why people might still think this despite the evidence.

4. An icosahedral die is a die with 20 sides that is sometimes used to play certain games. What is the proportion of successive rolls that have a certain face (assume they are numbered 1-20) will be face up?

5. A couple plans to have three children. There are 8 possible arrangements of girls and boys. For example, GGB means the first two children are girls and the third is a boy. All 8 arrangements are approximately equally likely. a) Write down all 8 arrangements of the sexes of three children. What is the proportion of any one of these arrangements? b) What is the proportion of outcomes such that the couple's children are 2 girls and a boy (not necessarily in that order)?

6. A newspaper article on drunk driving cited data on traffic deaths in Rhode Island: "Forty-two percent of all fatalities occurred on Friday, Saturday and Sunday, apparently because of increased drinking on the weekends." What percent of the week do Friday, Saturday and Sunday represent? Are you surprised that 42% of fatalities occur on those days? How might data for the number of cars on the road on those days possibly change or reinforce that perception?

7. An article in a Midwestern newspaper about flight delays at a major airport said: 'According to a Gannet News Service study of US airline's performance during the past five months, Chicago's O'Hare Field scheduled 114,370 flights. Nearly 10%, 1,136 were canceled.' Check the paper's arithmetic. What percent of scheduled flights were actually cancelled?

8. The number of Americans living below the poverty line increased from 24,975,000 to 43,569,000 in the 34 years between 1976 and 2009. What percentage increase was this? You should not conclude from this that poverty grew more common in the US during these years. Why not?

9. Choose an acre of land in Canada at random. The probability that it is forest is 0.45, and that it is pasture is 0.03. a) What is the probability that the acre chosen is not forested? b) What is the probability that it is either forest or pasture? c) What is the probability that a randomly chosen acre in Canada is something other than forest or pasture?

10. In each of the following situations, state whether or not the given assignment of probabilities to individual outcomes is legitimate, that it, it satisfies the rules of probability. If not, give specific reasons for your answer.
    a) When a coin is spun, P(H)=0.55, P(T)=0.45.
    b) When two coins are tossed, P(HH)=0.4, P(HT)=0.4, P(TH)=0.4, P(TT)=0.4.
    c) Plain M&Ms have not always had the colors they do now. In the past there were no red or blue candies. Tan had probability 0.1 and the other 4 colours had P(Brown)=0.2, P(Yellow)=0.2, P(Green)=0.1, P(Orange)=0.1.

11. A 'psychic' runs the following ad in a magazine: 'Expecting a baby? Renowned psychic will tell you the sex of the unborn child from any photograph of the mother. Cost: $20. Money-back guarantee.' This may be a profitable con-game. Suppose that the psychic simply replies with 'boy' all the time. In the worst case, everyone who has a girl will demand their money back. Suppose that the probability of having a boy is 0.51 and the probability of having a girl is 0.49. What is the 'psychic's' expected profit on each pregnant woman that sends her money?

12. A two-way table provides the counts of data for the values of two variables and their relationships. Use the table below to answer the questions that follow.

Count of Opinion	Column Labels			
Row Labels	Elderly	Middle-aged	Young	Grand Total
Agree	18	48	16	82
Disagree	21	45	19	85
Neutral	15	38	15	68
Strongly agree	20	48	18	86
Strongly disagree	20	39	19	78
Grand Total	94	218	87	399

a. If a random person is selected from the data, what is the probability that the person is Middle Aged?
b. What is the probability the person is of the Strongly Agree opinion?
c. What is the probability the person is both Middle Aged and Strongly Agree?
d. What is the probability the person is either Strongly Agree or Middle Aged?
e. What is the probability the person is neither Strongly Agree or Middle Aged?
f. What is the probability the person Strongly Agrees given that they are Middle Aged?
g. What is the probability the person is Middle Aged, given that they Strongly Agree?

13. Use the two-way table below to answer the questions that follow.

Count of Job Status	Column Labels

Row Labels	0	1	2	Grand Total
F	98	126	83	307
N	16	86	163	265
P	39	59	80	178
Grand Total	**153**	**271**	**326**	**750**

a. If a random person is selected from the data, what is the probability that the person is working full time?
b. What is the probability the person has no children?
c. What is the probability the person is both working full-time and has no children?
d. What is the probability the person is either working full-time or has no children?
e. What is the probability the person is neither working full-time or has no children?
f. What is the probability the person is working full-time given that they have no children?
g. What is the probability the person has no children given that they work full-time?

14. Three employees are to be selected at random out of an employee pool of 41 to attend a conference in Switzerland next year. How many different ways can the tickets to Switzerland be given out?

15. A puzzle writer is creating a word-scramble puzzle from the name "MAXIMILLIAN". How many different options are there?

16. A soccer team has 11 players but only five can play at any one time (four plus goalie). Each player is assigned a specific position for the opening toss. How many different ways can those five players be chosen to start?

17. A bowl of marbles has 17 blue marbles, 11 red marbles, 14 green marbles, 20 black marbles, and 4 yellow marbles. How many ways are there to select one marble of each color?